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Serial No. \_\_\_\_\_

Appn. Filed : \_\_\_\_\_

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Appn. Title: METHOD AND APPARATUS FOR DETERMINING  
CHARACTERISTICS OF THIN FILMS AND COATINGS ON SUBSTRATES

Examiner/GAU: \_\_\_\_\_

Mailed: *January 26, 2004*  
At: *Campbell, California*

Information Disclosure Statement

Commissioner for Patents

P.O. Box 1450, Alexandria, VA 22313-1450

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon. Following are comments on references pursuant to Rule 98:

CSM Instruments, Switzerland produces a micro-scratch tester for testing coatings and films by generating a controlled scratch with a conical point indenter, either a Rockwell C diamond tip or a sharp steel tip, drawn across a coated surface under either a constant or a progressively increasing load. A disadvantage of such point tips is that the end of the indenter is very sharp, so when the tip is pressed into the tested coating, it develops a very high contact pressure, and even when it does not break through the coating yet, it produces significant stress deep in the substrate. So, the test results are affected by the properties of the substrate, which makes it impossible to accurately measure the properties of thin films and coatings.

U.S. Patent No. 6,502,455 issued to Gitis, et al. on January 7, 2003 and U.S. Patent No. 5,696,327 issued to He Huang, et al, on December 9, 1997 describe a micro-scratch test conducted with the use of a blade-type indenter. The test is carried out by pressing an indenter onto a coating and moving either blade or the test sample in relation to each other, with simultaneous application of both normal load and lateral force to the indenter.

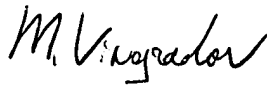
In the known scratch test methods, except for the one described in the aforementioned U.S. Patent No. 6,502,455, only friction and acoustic measurements were combined together, whereas another known test method with measurements of electric properties (impedance, resistance, capacitance) may be carried out separately, in combination with vertical indentation test, particularly because of non-conductivity of the diamond tips used for microscratch testing. As a result, for many materials the exact determination of the critical load was difficult or impossible, especially in cases of ultra-thin or multi-layered coatings.

Although the above problems are partially solved in U.S. Patent No. 6,502, 455, the method described in it is ineffective for the ultra-thin films of the order of tens

of nanometers to several nanometers, when they may be non-continuous, and when the scratch or indentation marks in the films are undistinguishable from the surface roughness. In other words, if the contact surface of the indenter is the same or smaller than an uncoated or scratched area of the tested object, interpretation of the test results becomes unreliable.



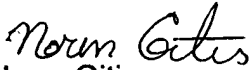
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